ANTHIS VALVE ENTERPRISES · CRYOGENIC CASE STUDY

3× THE SERVICE LIFE ON A FAILING LNG CRYOGENIC BALL VALVE

A main ship-to-shore isolation valve was leaking every three months and taking half a year to repair overseas. Anthis found the design flaw the original manufacturer missed, re-engineered it, and returned zero-leakage performance, delivered locally in under a month.

- 3× service life
- 83% faster turnaround
- 1/3 the cost
- Zero leakage

Anthis Valve Enterprises, Inc. | Houston, TX
Customer identity withheld under NDA. Referenced throughout as a major Gulf Coast LNG export terminal.

EXECUTIVE SUMMARY

THE BOTTOM LINE

A major Gulf Coast LNG export terminal was losing a main loading-arm isolation valve to seal failure about every three months. Each repair meant shipping the valve back to its original manufacturer overseas, a turnaround of six months or more, at a steep cost and with a standing environmental-compliance risk from external leakage.

Anthis diagnosed the failure as a design-level flaw in the seat's thermal compensation, not ordinary wear. We re-engineered the Belleville-spring seat, upgraded the seal materials, and refined the ball-to-seat fit to a zero-leakage standard. The rebuilt valve returned to service and held.

3×	9+ mo	83%	1/3
the service life of the original-equipment valve	in service with zero leakage	faster turnaround, 6 months to under 1	of the original maintenance cost

Why this matters. For an LNG terminal, a loading-arm valve that fails every few months and then takes six months to fix is not a maintenance line item. It is a production and compliance risk. This paper shows how an engineering-led local rebuild removed that risk, and what it means for any terminal running OEM cryogenic valves that keep failing.

INTRODUCTION

THE MOST CRITICAL LINK

In the LNG maritime chain, the ship-to-shore interface is where the risk concentrates. The main isolation valves on the marine loading arms cycle constantly, and they live a punishing double life: one face in Houston's hot, humid air, the bore holding cryogenic LNG at -161.5°C. Every cycle drives the materials through a full expansion-and-contraction swing, and the seal has to survive all of it.

The Gulf Coast is in the middle of a major LNG export buildout, with new terminals and loading arms coming online across Texas and Louisiana. That means a growing population of high-cycle cryogenic valves in the most critical service on the dock. When an original-equipment valve underperforms in that duty, a terminal faces a hard choice: live with repeat failures, or lose the arm for months waiting on an overseas repair.

What you will learn: why a design-level seat flaw causes repeat cryogenic seal failures, and how a local, engineering-led rebuild restores reliability faster and at lower cost than an OEM return.

Cryogenic valve work in the Anthis shop, staged beside cryogenic test dewars.

WHO THIS PAPER IS FOR

LNG terminal reliability & maintenance

Reliability managers, maintenance managers and turnaround planners responsible for loading-arm uptime and leak-free operation.

Loading-arm OEM installed base

Teams running Niigata, TechnipFMC, Kanon or Emco Wheaton arms who need a faster, local service-and-modification path.

EPC & third-party O&M

Engineering and maintenance partners who specify and service critical cryogenic valves for terminal operators.

THE PROBLEM

A VALVE THAT WOULD NOT STAY SEALED

Leaking in about three months

The original-equipment valve lost its seal far short of a normal service interval under high-frequency isolation duty.

Six-plus month turnaround

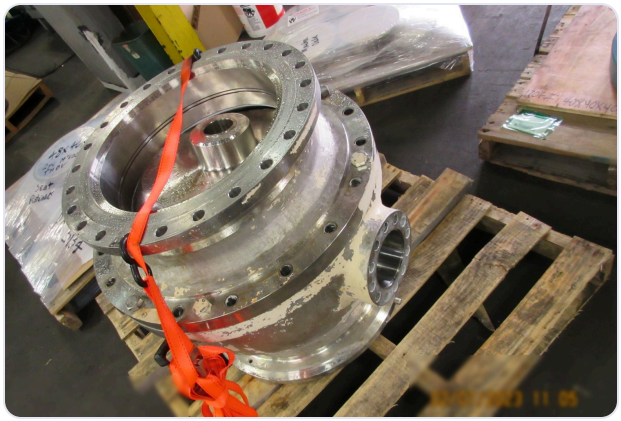
Every repair meant shipping the valve back to the original manufacturer overseas, with the loading arm out of service the whole time.

High cost per event

Each return-and-repair cycle carried a steep price on top of the lost production.

Compliance & safety exposure

External leakage on a cryogenic service puts environmental limits and dock safety at risk.



An as-received valve body on the Anthis shop floor at the start of the project.

Downtime is the real cost.

A shut-down loading arm can cost an LNG terminal millions of dollars a day. A valve that fails every few months, then takes six months to come back, is a production risk, not a line item.

THE DIAGNOSIS

WE DO NOT GUESS. WE TEAR IT DOWN.

Anthis stripped and inspected two of the units. The failure was not wear from age. It was built into the seat design: the pre-load structure could not hold sealing force through repeated ambient-to-cryogenic cycling.

Uneven load from thermal mismatch

The seat and body materials contract at different rates, so at -161.5°C the sealing face was loaded unevenly.

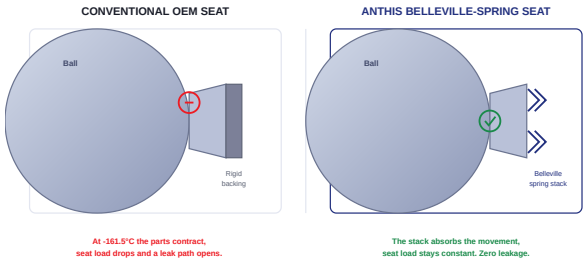
Spring-back decay at cryogenic temperature

The seat's elastic recovery faded after repeated open-and-close cycles, so it stopped pushing back against the ball.

Accelerated wear, then a leak

Less spring-back meant less sealing force, which drove wear on the sealing face and, finally, external leakage.

Inspection of the sealing face during teardown.



How the seat holds, or loses, its sealing force through a temperature swing.

THE SOLUTION

A REPAIR TO THE DESIGN, NOT THE DRAWING

The original manufacturer rebuilds to the same drawing, including the flaw that caused the failure. Anthis re-engineered the seat so it holds a constant seal across the full temperature range.

1

RECALCULATED THE SEAL LOAD

We recalculated the seat contact pressure and rebuilt the Belleville (disc) spring compensation so the seat holds constant sealing force as the valve moves between ambient and cryogenic temperature.

2

UPGRADED THE SEAL MATERIALS

We moved to high-performance modified PTFE and UHMWPE seats, better suited to Houston humidity and repeated cryogenic cycling than the original materials.

3

REFINED THE BALL-TO-SEAT FIT

We reworked the ball-to-seat lapping to a strict zero-leakage standard, verified on test before the valve left the shop.

Cryogenic bonnet work per **MSS SP-134** and **BS 6364**. Bonnet welding by **ASME-qualified welders** on impact-tested procedures. Final leakage verified by **helium testing**.

The rebuilt cryogenic valve, bore and seat finished to a zero-leakage standard.

Reassembly and fit-up in the Anthis shop.

THE RESULTS

SEALED, IN SERVICE, DELIVERED FAST

3×
the original-equipment service life

9+
months in service, zero leakage

83%
faster turnaround (6 mo to under 1)

1/3
the original maintenance cost

TURNAROUND, OEM RETURN VS. ANTHIS

MEASURE	ORIGINAL-EQUIPMENT PATH	ANTHIS REBUILD
Service life	Leaking in ~3 months	**9+ months, zero leakage**
Turnaround	6+ months, shipped overseas	**Under 1 month, local**
Approach	Rebuilt to the original drawing	**Root-cause re-engineering**
Sealing	Leak path returns under cycling	**Zero leakage, verified on test**
Cost	Full OEM repair price	**One-third the cost**

CONCLUSION

RELIABILITY YOU DO NOT WAIT SIX MONTHS FOR

This was not a lucky rebuild. It was a measured result on a critical cryogenic service, verified on test before it shipped. Three takeaways carry over to any terminal running OEM cryogenic valves that keep failing.

Diagnose the design

Repeat failures usually point to a design-level cause. Rebuilding to the original drawing rebuilds the flaw. Root-cause engineering fixes it for good.

Local beats overseas

A Gulf Coast rebuild turned in under a month, against six months for an OEM return, and removed the arm from the critical path far sooner.

Sealing is compliance

A true zero-leakage seal is not just uptime. It removes a source of fugitive LNG emissions and the compliance exposure that comes with it.

THE BIGGER PICTURE

As the Gulf Coast LNG fleet grows, so does the population of high-cycle cryogenic valves in critical loading service. A local, engineering-led repair and modification path is a practical way to de-risk that growth, keeping critical valves sealed, in service, and out of a six-month repair queue.

STANDARDS & SOURCES

1. MSS SP-134, Valves for Cryogenic Service Including Requirements for Body/Bonnet Extensions.
2. BS 6364, Specification for Valves for Cryogenic Service.
3. ISO 15848-2, Industrial valves, measurement, test and qualification procedures for fugitive emissions (production acceptance test).
4. API 6D / API 598, Pipeline and pipeline valves, and valve inspection and testing.
5. Anthis Valve Enterprises internal teardown inspection and hydrostatic / helium test records, 2023.

WHY ANTHIS · GET IN TOUCH

THE HOUSTON SHOP FOR THE HARD WORK

Anthis Valve Enterprises has repaired and modified industrial valves since 1971, with more than 1,500 projects behind us. We are an API 6D repair and modification shop with our own engineering team, and cryogenic modification is our specialty. When a valve keeps failing or needs specialty work an original manufacturer cannot turn quickly, we get it right and get it back fast.

- Cryogenic service to -350°F
- Gate, globe, check, ball & butterfly to 48″
- Hydrostatic testing to 20,000 psi
- API 6D lock-open levers & slam retarders
- Helium / ISO 15848 leak testing
- In-house CNC, welding & painting

> *"Excellent service, quick response, and quality work."*
>
> **Midstream Valve**

> *"We have a great working relationship with Anthis and will continue to utilize their facility to help us serve clients together."*
>
> **Microfinish Valves**

> *"Anthis does a good job meeting the delivery requirements. If there's any problem, they fix it."*
>
> **Patton Myhre Sourcing**

RUNNING OEM CRYOGENIC VALVES THAT KEEP FAILING?

Send us the problem valve. We will diagnose the root cause, quote the modification, and turn it around locally, faster than a return to the original manufacturer.

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VALVE REPAIR & MODIFICATION · SINCE 1971